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HEAT MANAGEMENT IN SOLID STATE RADIATION GENERATION DEVICES SUCH AS LIGHT EMITTING DIODES (LED)

FIELD OF THE INVENTION

The present invention relates a excessive heat treatment for Light Emitting Diode type.

BACKGROUND OF THE INVENTION

It is known that practical design and application of Light Emitting Diodes (LED) type devices for use in Area Lighting and like schemes are limited by the present art due to thermo-energy-management issues. That is, the LED device development curve, to date, has been to provide greater light output without significant increase in total volume of the individual LED device. As such, the watts per cubic volume of byproduct heat generated, per LED device, has also increased.
It is known that LED devices, when light emitting, exhibit negative temperature coefficient aspects, i.e. for the same power input, as the device's operating heat rises, the device's light output decreases. Further, in the recent past, it has become accepted that the relationship, between LED decrease in light output due to increased operation temperature, can be expressed approximately, as a percent light output to degree centigrade increase, as one to one. That is, as the LED device's operating temperature increases one degree it can by approximated that the device will lose one percent of its light output.
In prior art methods attempts have been made to solve the negative temperature coefficient issues. As an example, in LED highway traffic signal devices housings with ventilation configurations, both of passive (convection-type) and active (fan-driven-type) have been provided to prevent the LED from overheating. Present art LED traffic signal devices also address the inherent negative temperature coefficient nature via the electrical power supply. These approaches either increase power to the device to compensate for light output loss or discuss the quality of the provided electrical power such as sine vs square wave in attempts to moderate the production of byproduct heat, i.e. waste heat.

There is therefore a need for LED devices' of long service life and high electric power-to-light efficiency.

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SUMMARY OF THE INVENTION

It is an object of this invention to provide a solution for excessive heat treatment for Light Emitting Diode type Solid State Components in order to safeguard maximal light output, correct wavelengths of light colors and maximal lifecycle of individual LEDs in critical applications.

It is another object of this invention to address the configuration of LED driven street light applications in order to provide a maximal effective distribution of illumination over critical areas as but not limited to roads, freeways, bridges and other traffic areas.

The excessive heat treatment is based on moving the heat from the LEDs via thermal electric module(s) and moving the heat away from LEDs internal environment.

The present invention has three ways, individually or in combination, of heat movement from the LED(s). First is the Thermoelectric Module, second is the heat sink attached to the hot side of the Module and third is the isolated core of metal, moving heat from the heat sink. The core length can be adjusted for different environments. To provide effective transport of heat from the heat sink through the core. The core needs to be covered with material with very low thermal conductivity. Use of Silica Aerogels type materials have thermal conductivity of 0.012 W/m-K . The heat moving material would require a higher thermal conductivity such as Aluminum which has a thermal conductivity of 204 W/m-K or Copper which has 386 W/m-K.

The present Invention utilizes the natural negative temperature, i.e. for the same power input as the device's operating heat rises the device's light output decreases, coefficient by sampling the individual and/or collective LED light output and reducing the individual and/or collective LEDs' microenvironment's temperature as the operating temperature of the LED device(s) rise as a result of byproduct heat or waste heat generated by the LED device as light is produced. That is, once energized LED light output begins to decline as operating temperatures rise. As it is desirable that the present Invention's application as area lighting, provide a relatively constant level of illumination, said illumination is sampled and the LED device(s) light output is moderated by adjusting the effective temperature to achieve the desired illumination level(s). For example, an LED device is initially energized wherein the LED's microenvironment is at 20^{o} C. There occurs a brief period of higher than average light output to unit of electric power supplied before Joule heating migrates

to the light emitting component of the LED device. Following the aforementioned brief rise in light output, operating temperatures rise and light output declines.

In one preferred embodiment the present invention utilizes thermoelectric device(s) to maintain the desired LED operating temperature, where the actual light output for feedback on the appropriate operating temperature is monitored. That is, reducing the operating temperature increases the light output.

The present invention addresses LED device negative temperature coefficient, and utilizes said coefficient to "pre-chill" the LED device before energizing, to specific temperatures. As an example, if an LED device, before being energized, has a microenvironment of 20° C., but is chilled to and maintained at 0° C., the LED device will provide 20% more light output per unit of electrical power supplied. In fact, the act of chilling the near physical environment of the LED device will increase the efficiency of the electrical current in the electrical supply wiring and reduce the by-product or waste heat generated by said electrical supply wiring. Due the physical constraints usually encountered with area lighting type devices, such as but not limited to design wind loadings on highway lighting equipment, chilling, in this example allows the use of 20% fewer LED devices for the same area illumination thus reducing the overall equipment package volume. Finally, chilling directly affects the LED device's permanent degradation light output curve.

In another preferred embodiment the present invention utilizes the electrical service wiring to provide the conduct for temperature moderation of the electronic device.

The present uses preferably thermoelectric devices to directly chill the electrical power supply wiring and utilizes the wiring's metal component as the thermo-energy conduct to wick byproduct heat away from the LED device. In a preferred embodiment the LED device is isolated from its local environment so as to achieve a sustainable temperature differential between the LED device and the local environment whereby the LED, in an operating or non-operating state, is kept at a temperature lower than the local environment. This requires larger than otherwise electrical power supply wire metal components and greater than otherwise wiring insulation so as to transport byproduct heat from the insulated LED device. Once the byproduct heat to transported away, by the temperature gradient generated by the physically distant thermoelectric devices, it can be ejected into the macro-environment without said heat energy parasitically raising the operating temperature

of the insulated LED device. Given that thermoelectric devices can be thermally reversed by simple current reversal, the same aforementioned configuration whereby the microelectronic device is thermally insulated allows the thermostating of the LED's effective microenvironment by injecting heat via thermoelectric device thru the electric power supply wiring where sub macro-environments are encountered. This would be useful where the non-operating LED device would be exposed to such conditions and where the operating LED device would not generate sufficient byproduct heat or waste heat to maintain an immediate microenvironment above minimum acceptable temperatures

Another advantage of thermally insulating the LED device and utilizing the electrical power supply wiring as the heat energy transport conduct is that it provides a superior configuration to applying a "current pulse" to the LED. LED illumination occurs instantaneously while Joule heating occurs throughout the LED. As such there will ~~in~~ be a short time period where the LED is not thermally degraded and the thermo inertia can be utilized to wick the byproduct heat away before the next "current pulse." This allows the LED device to operate at a higher light output per unit of electric power supplied due to lower operating temperatures. However, when such a configuration is used for activities such as area illumination, the "current pulse" should be time-lapsed such that the "current pulse" rate is above the fusion-flicker rate of the human eye. That is, the "current pulse" rate should be above the discernable "flicker" rate of human vision. That said, given the very-large-array (VLA) configurations of present art LEDs for applications such as area lighting, individual LEDs within a VLA can be "current pulsed" if the individual LED light output as a percentage of total VLA light output either remains small or is coordinated with a "current drop" to a close by LED. Matching one LED with a "current pulse" with a "current drop" to a close by LED results to an overall decrease in VLA operating temperature.

According to the first aspect the present invention relates to a light illuminating fixture, comprising:

- at least one Light Emitting Diode (LED), and

- at least one thermoelectric module arranged such that a first side end of one or more of said at least one thermoelectric module is in contact with said at least one LED and a second side end is in contact with the surroundings thereby creating a temperature gradient between said first and second side

ends following in heat exchange between said at least one LED and the surroundings resulting in lowering or increasing the temperature of said at least one LED such that an optimal temperature in said at least one LED is obtained and thereby enhancing its lifetime.

In one embodiment the fixture is enclosed in a pressure chamber, wherein the pressure may be with higher pressure or lower values than ambient pressure. The chamber may be attached to a thermoelectric module and or cascading modules and wherein preferably the module(s) is (are) attached to heat sink(s). It is preferred that cord(s) of high thermal conductivity thread are attached to either thermoelectric module(s) and or heat sink(s) and said thread and or cord(s) are insulated along its length with low thermal conductivity material(s), wherein said cord(s)' mass is in proportion to the maximal in-situ ambient temperature and located inside Claim 8's fixture's structure. Preferably said insulating material(s) cover the inside surface of said camber except where said camber is in contact with thermoelectric module(s).

In another embodiment the thermoelectric module(s)' cold side is attached to the mounting side of the LED(s) and the hot side attached to the inside cover of said chamber, whereas in another embodiment the thermoelectric module(s)' hot side is attached to the mounting side of the LED(s) and the cold side attached to the inside cover of said chamber.

In still another embodiment a thermostatic instrument, via temperature of LED mounting side and or thermoelectric module(s)' cold side and or hot side, and or chamber ambient temperature, controls current applied to the thermoelectric module(s) to maintain optimal temperature. A control unit can change the current to the thermoelectric module(s) in value and or direction according to ambient conditions for the purpose of maintaining optimal temperature inside the pressure chamber.

The light measuring instrument, via sampling of LED radiation output may be used to control the current applied to the thermoelectric module(s) to maintain predetermined LED radiation output.

The thermoelectric module(s)' hot side may be attached to the mounting side of the LED(s) and the cold side attached to the outside cover of said chamber, thereby

through a temperature gradient the heat is transferred from the LED to the surrounding. .

Also an thermostatic instrument, via temperature of LED mounting side and or thermoelectric module(s)' cold side and or hot side, and or camber ambient temperature may be used to control the current applied to the thermoelectric module(s) to maintain optimal temperature.

In one embodiment a control unit can be used change the current to the thermoelectric module(s) in value and or direction according to ambient conditions for the purpose of maintaining optimal temperature inside the pressure chamber.

Preferably a light measuring instrument, via sampling of LED radiation output, controls current applied to the thermoelectric module(s) to maintain predetermined LED radiation output, wherein said Thermoelectric module(s) is (are) preferably thermally insulated from said LED and in thermo contact with LED(s) electrical wiring.

A thermostatic instrument, via temperature of LED mounting side and or thermoelectric module(s)' cold side and or hot side, and or camber ambient temperature may be provided to control current applied to the thermoelectric module(s) to maintain optimal temperature.

In another embodiment a control unit is provided to change the current to the thermoelectric module(s) in value and or direction according to ambient conditions for the purpose of maintaining optimal temperature inside the pressure chamber.

In still another embodiment a light measuring instrument, via sampling of LED radiation output is provided to control current applied to the thermoelectric module(s) to maintain predetermined LED radiation output.

A control unit may be used to alternate pulsed current to LED(s) and then Thermoelectric module(s) and then back to the LED(s).

A thermostatic instrument, via temperature of LED mounting side and or thermoelectric module(s)' cold side and or hot side, and or camber ambient temperature is in one embodiment used to control the time period of individual pulses

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and time period between pulses of current applied to the thermoelectric module(s) to maintain optimal temperature.

A control unit may be provided to change the current to the thermoelectric module(s) in value and or direction according to ambient conditions for the purpose of maintaining optimal temperature inside the pressure chamber.

In one embodiment a light measuring instrument, via sampling of LED radiation output, controls current applied to the thermoelectric module(s) to maintain predetermined LED radiation output.

In another embodiment a thermostatic instrument controls thermoelectric module(s) for the purpose of maintaining optimal temperature inside said chamber.

Also a light measuring instrument, via sampling of LED radiation output may be used to control the thermoelectric module(s) for the purpose of maintaining optimal temperature inside said chamber.

In still another embodiment a control unit is provided to activate at least one of said thermoelectric module(s), to either cool or heat the fixture's LED(s) before energizing individual and or combinations of the fixture's LED(s).

In one embodiment a transparent, consisting of high thermal conductivity material(s), caps the lens component of the fixture's LED(s).

In another embodiment at least one of said thermoelectric module(s) are thermally connected to said transparent cap(s).

In another aspect the present invention relates to a method for maintaining Light Emitting Diode (LED) and at optimal temperature and thereby enhancing the lifetime of the LED, said method comprising the steps of:

- placing at least one LED in a closed interior in a housing for protecting the LED from the surroundings, and

- providing at least one thermoelectric module for transferring the heat from said LED in said interior towards the surroundings,

wherein one or more of said at least one thermoelectric module is arranged such that a first side end of one or more of said at least one thermoelectric module is in contact with said at least one LED and a second side end is in contact with the surroundings thereby creating a temperature gradient between said first and second side ends following in heat exchange between said at least one LED and the surroundings resulting in lowering or increasing the temperature of said at least one LED such that an optimal temperature in said at least one LED is obtained and thereby enhancing its lifetime.

In one embodiment the thermoelectric module is Peltier based.

In another embodiment said at least one thermoelectric module comprises more than two thermoelectric modules arranged serially and or parallel together.

Also, said housing insulated and thereby said interior.

In still another embodiment a overpressure of an inert gas within said housing is provided for preventing moisture from the surroundings within said interior.

The phrase “Light Emitting Diode” or word “LED” may be replaced with the phrase “LED supporting electronic conmponent(s)”.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 presents a section of a typical street light fixture and the light cone it produces from source to surface.

Figure 2 presents a section of the invention's embodiment as street light fixture and the light cone it produces from source to surface.

Figure 3 presents a section through the invention and three different methods of transporting heat from the LEDs

Figure 4 presents a diagram of the overall system

Figure 5 presents the configuration of a heat spot treatment

Figure 6 presents the configuration of water based cooling system

Figure 7 presents the configuration of a fluid based cooling system

Figure 8 presents a diagram of the heat transport as a function of time for three different conditions: 1. Daytime max ambient temp <45°C, unlit LEDs

2. Night time max ambient temp 15°C lit LEDs

3.-Day time max ambient temp. <45°C lit LEDs

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present Invention's embodiment is a LED based fixture with excessive heat transfer apparatus attached to the LEDs, mounted individually and or in groups in critical out door applications for the purpose of light signalling and or wide area illumination type applications. The apparatus consists of **(1)** Peltier based thermoelectric module attached to the **(2)** Mounting plate of the individual **(3)**LED.

If the LEDs are arranged within a housing the thermoelectric module may also be attached to the housing, and/or be a structural component of said housing.

The LEDs can be grouped in any geometrical order and attached to any curved and or even surface. The angularity and alignment of (3) LEDs for the purpose of illumination and signalling is not an issue in this invention as this aspect is covered by other inventions. The (1) Peltier termoelectric module has one side **(4)** hot and the other **(5)** cold when activated with an electric current. The (5) cold side is facing the (2) Mounting plate of the (3) LED. A **(6)** Metal heat sink is attached to the (4) hot side of the (1) Peltier. **(7)** Insulating material; Aerogels, are fit around all components to prevent heat flow from ambient to (5) cooling area when ambient temperature is higher than the operating temperature of the cold side of the (1) Peltier module and to prevent back flow of heat in the system. (7) Aerogels have a very low thermal conductivity and even in very thin layers they are capable of insulating and or stopping the heat flow. The transition between the hot side of the Peltier module and the heat sink must be a vapour free material and able to withstand 1bar.The present invention is constructed having two chambers **(8)**Chamber 1 is for the LEDs and the Peltier module. It is insulated with Aerogels exempt where the heat sink is attached. The chamber 1 has a higher gas and or air pressure than average ambient pressure to prevent the flow of vapour into the chamber . The chamber 1 can be filled with gases other than air to further prevent moisture inside the chamber. **(9)** Chamber 2 is for moving heat from the heat sink out to the **(15)**-support structure. Using another Peltier module or **(30)** cascading modules enables us to stabilize the heat flow and provide more constant temperature around the operating LED. We present three approaches in treating the heat after it has been moved from Camber 1 A) for

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moderate climates. B) For hot environments. C) For extreme conditions A) for moderate climates we use only two (1) Peltier modules. The (1) Peltier module is attached to a heat sink (**11**) Copper core is attached to the heat sink (**12**) fins, The copper is insulated with (7) Aerogel filt and (**13**) vapour seal. The length of the core depends on the type of (15) support structure and the general climate on site. (9) Chamber 2 can have mechanical fans or any form of ventilation to further move excessive heat out from the (9) chamber. B) For hot environments we add Peltier modules in a cascading fashion. (30) The cascading Peltier modules are in chamber 2 the effect of cascading Peltier Modules is known and the solution is used when even flow of heat, over the distance of the cascading modules, is important. C) In extreme conditions, the (9) chamber can be fitted with water based cooling system in (**20**) copper pipes with (**21**) in-pipe magnetic pumps. (29) The pipes are threaded through the (12) fins. The water is used to move the heat from the hot heat sink into a water chamber. The water can be used at the ambient temperature but can be cooled with Peltier modules when ambient temperature is higher than 40°C. Figure 1. Shows a diagram of Heat development over time combined with the percentage of light output versus power input. It is clear from the diagram that a LED will decrease in light output as the internal temperature of the LED rises. Bigger portion of the power applied turns into heat energy when the internal temperature rises. When the invention is used to lower the operating temperature of the LED, the light output will rise and a lower portion of the power applied turns into heat energy. Thru recent experiments for specific LEDs, the maximal level is obtained when the operating temperature is 12°C. Nearly 80% of the energy applied turns into light. To further treat the thermal management we have discovered that the LED develops hot spots on the mounting plate. By treating these hot –spots with smaller Peltier modules we can use less energy for heat transfer. A (**14**) thermostat is mounted on the heat source of the LED. When temperature rises above 12°C the (1) Peltier module is activated and cools the hot –spot to 4°C. Then it turns off and allows the temperature to rise to 12°C and the Peltier is activated again. The temperature on the hot side of the Peltier module rises from 20°C (given ambient temperature) to 60°C when the cooling of the LED peaks. From the time it takes the LED to rise the temperature from 4°C to 16°C The heat sink must be able to lower the temperature of the hot side of the Peltier module to +12°C above ambient temperature (i.e. 32°C). This can be calculated with known formulas.

Time required changing the temperature of an object:

t = (m x Cp x DT) / Q

Where:

t = Time interval (seconds)

m = Weight of the object (kg)

Cp= Specific heat of material (J / (kg K))

DT = Temperature change of object (Kelvin)

Q = Power added or removed (Watts)

One LED has an aluminum mounting plate of 0.00314 Kg

The specific heat of Aluminum is 900 J/Kg K

Temperature change is 16-4=12°C

2W of power is entered into the system

This will take ~17 seconds

This is the time the heat sink must cool from 60°C to 32°C or 28°C

We can now reverse the formula and find out how heavy the heat sink must be to be able to cool the hot side of the Peltier module

m=(Q x t)/ (Cp x DT)

1.8 Kg of aluminum is needed to hold this system stable or 666 cubic cm

Given if the dimensions of one LED are 2.54 cm x 2.54 cm this makes the total length of the heat sink 102 cm. If we add another Peltier to the system to lower the hot side of the first Peltier we can move the hottest side further away from the LEDs. Adding the core to the system equals the 1.8 Kg need for the heat sink. One beneficial consequence occurs when the electric contacts and cores have the same temperature as the LEDs at an optimal temperature (12°C). This will affect the wavelength of the LEDs to match closer the theoretical wavelength of the specific LED.

CLAIMS

1. A light illuminating fixture, comprising:

- at least one Light Emitting Diode (LED), and
- at least one thermoelectric module arranged such that a first side end of one or more of said at least one thermoelectric module is in contact with said at least one LED and a second side end is in contact with the surroundings thereby creating a temperature gradient between said first and second side ends following in heat exchange between said at least one LED and the surroundings resulting in lowering or increasing the temperature of said at least one LED such that an optimal temperature in said at least one LED is obtained and thereby enhancing its lifetime.

2. A fixture in accordance with Claim 1, wherein said fixture is enclosed in a pressure chamber with higher pressure values than ambient pressure.

3. A fixture in accordance with Claim 1, wherein said fixture is enclosed in a pressure chamber with lower pressure values than ambient pressure.

4. A fixture in accordance with Claim 2, wherein the chamber is attached to a thermoelectric module and or cascading modules.

5. A fixture in accordance with Claim 3, wherein the chamber is attached to a thermoelectric module and or cascading modules.

6. A fixture in accordance with Claim 4, wherein the module(s) is (are) attached to heat sink(s).

7. A fixture in accordance with Claim 5, wherein the module(s) is (are) attached to heat sink(s).

8. A fixture in accordance with Claim 6 or Claim 7, wherein cord(s) of high thermal conductivity thread are attached to either thermoelectric module(s) and or heat sink(s) and said thread and or cord(s) are insulated along its length with low thermal conductivity material(s).

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9. A fixture in accordance with Claim 8, wherein said cord(s)' mass is in proportion to the maximal in-situ ambient temperature and located inside Claim 8's fixture's structure.

10. A fixture in accordance with Claim 2 or Claim 3, wherein said insulating material(s) cover the inside surface of said camber except where said camber is in contact with thermoelectric module(s).

11. A fixture in accordance with Claim 2 or Claim 3, wherein thermoelectric module(s)' cold side is attached to the mounting side of the LED(s) and the hot side attached to the inside cover of said chamber.

12. A fixture in accordance with Claim 2 or Claim 3, wherein thermoelectric module(s)' hot side is attached to the mounting side of the LED(s) and the cold side attached to the inside cover of said chamber.

13. A fixture in accordance with Claim 12, wherein a thermostatic instrument, via temperature of LED mounting side and or thermoelectric module(s)' cold side and or hot side, and or chamber ambient temperature, controls current applied to the thermoelectric module(s) to maintain optimal temperature.

14. A fixture in accordance with Claim 13, wherein a control unit can change the current to the thermoelectric module(s) in value and or direction according to ambient conditions for the purpose of maintaining optimal temperature inside the pressure chamber.

15. A fixture in accordance with Claim 12, wherein a light measuring instrument, via sampling of LED radiation output, controls current applied to the thermoelectric module(s) to maintain predetermined LED radiation output.

16. A fixture in accordance with Claim 2 or Claim 3, wherein thermoelectric module(s)' hot side is attached to the mounting side of the LED(s) and the cold side attached to the outside cover of said chamber.

17. A fixture in accordance with Claim 16, wherein a thermostatic instrument, via temperature of LED mounting side and or thermoelectric module(s)' cold side and or hot side, and or camber ambient temperature, controls current applied to the thermoelectric module(s) to maintain optimal temperature.

18. A fixture in accordance with Claim 17, wherein a control unit can change the current to the thermoelectric module(s) in value and or direction according to ambient conditions for the purpose of maintaining optimal temperature inside the pressure chamber.

19. A fixture in accordance with Claim 16, wherein a light measuring instrument, via sampling of LED radiation output, controls current applied to the thermoelectric module(s) to maintain predetermined LED radiation output.

20. A fixture in accordance with Claim 1, wherein said Thermoelectric module(s) is (are) thermally insulated from said LED and in thermo contact with LED(s) electrical wiring.

21. A fixture in accordance with Claim 20, wherein a thermostatic instrument, via temperature of LED mounting side and or thermoelectric module(s)' cold side and or hot side, and or camber ambient temperature, controls current applied to the thermoelectric module(s) to maintain optimal temperature.

22. A fixture in accordance with Claim 21, wherein a control unit can change the current to the thermoelectric module(s) in value and or direction according to ambient conditions for the purpose of maintaining optimal temperature inside the pressure chamber.

23. A fixture in accordance with Claim 20, wherein a light measuring instrument, via sampling of LED radiation output, controls current applied to the thermoelectric module(s) to maintain predetermined LED radiation output.

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24. A fixture in accordance with Claim 1, wherein a control unit alternates pulsed current to LED(s) and then Thermoelectric module(s) and then back to the LED(s).

25. A fixture in accordance with Claim 24, wherein a thermostatic instrument, via temperature of LED mounting side and or thermoelectric module(s)' cold side and or hot side, and or camber ambient temperature, controls the time period of individual pulses and time period between pulses of current applied to the thermoelectric module(s) to maintain optimal temperature.

26. A fixture in accordance with Claim 25, wherein a control unit can change the current to the thermoelectric module(s) in value and or direction according to ambient conditions for the purpose of maintaining optimal temperature inside the pressure chamber.

27. A fixture in accordance with Claim 24, wherein a light measuring instrument, via sampling of LED radiation output, controls current applied to the thermoelectric module(s) to maintain predetermined LED radiation output.

28. A fixture in accordance with Claim 1, wherein fixtures of Claim 10, Claim 16, Claim 20, and or Claim 24, are combined.

29. A fixture in accordance with Claim 28, wherein a thermostatic instrument controls thermoelectric module(s) for the purpose of maintaining optimal temperature inside said chamber.

30. A fixture in accordance with Claim 28, wherein a light measuring instrument, via sampling of LED radiation output, controls thermoelectric module(s) for the purpose of maintaining optimal temperature inside said chamber.

31. A fixture in accordance with Claim 1, wherein a control unit activates thermoelectric module(s), either as in Claim 10, or Claim 16, or Claim 20, or Claim 24 or in combination, to either cool or heat the fixture's LED(s) before energizing individual and or combinations of the fixture's LED(s).

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32. A fixture in accordance with Claim 1, wherein a transparent, consisting of high thermal conductivity material(s), caps the lens component of the fixture's LED(s).

33. A fixture in accordance with Claim 32, wherein thermoelectric module(s) are thermally connected to said transparent cap(s).

34. A fixture in accordance with Claim 33 and one or in combination with Claim 10, Claim 16, Claim 20, Claim 26 and Claim 27.

35. A method for maintaining Light Emitting Diode (LED) and at optimal temperature and thereby enhancing the lifetime of the LED, said method comprising the steps of:

- placing at least one LED in a closed interior in a housing for protecting the LED from the surroundings, and
- providing at least one thermoelectric module for transferring the heat from said LED in said interior towards the surroundings,

wherein one or more of said at least one thermoelectric module is arranged such that a first side end of one or more of said at least one thermoelectric module is in contact with said at least one LED and a second side end is in contact with the surroundings thereby creating a temperature gradient between said first and second side ends following in heat exchange between said at least one LED and the surroundings resulting in lowering or increasing the temperature of said at least one LED such that an optimal temperature in said at least one LED is obtained and thereby enhancing its lifetime.

36. A method according to claim 35, wherein the thermoelectric module is Peltier based.

37. A method according to claim 35 or 36, wherein said at least one thermoelectric module comprises more than two thermoelectric modules arranged serially together.

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38. A method according to any of the claims 35-37, wherein said at least one thermoelectric module comprises more than two thermoelectric modules arranged parallel together.

39. A method according to any of the claims 35-38, further comprising means for insulating said housing and thereby said interior.

40. A method according to any of the claims 35-39, further comprising means for providing an overpressure of an inert gas within said housing for preventing moisture from the surroundings within said interior.

41. A method according to the above claims within the phrase "Light Emitting Diode" or word "LED" is replaced with the phrase "LED supporting electronic conmponent(s)".

ABSTRACT

The present invention relates to a heat treatment for Light Emitting Diode type Solid State Components in order to safeguard maximal light output, correct wavelengths of light colors and maximal lifecycle of individual LEDs in critical applications.

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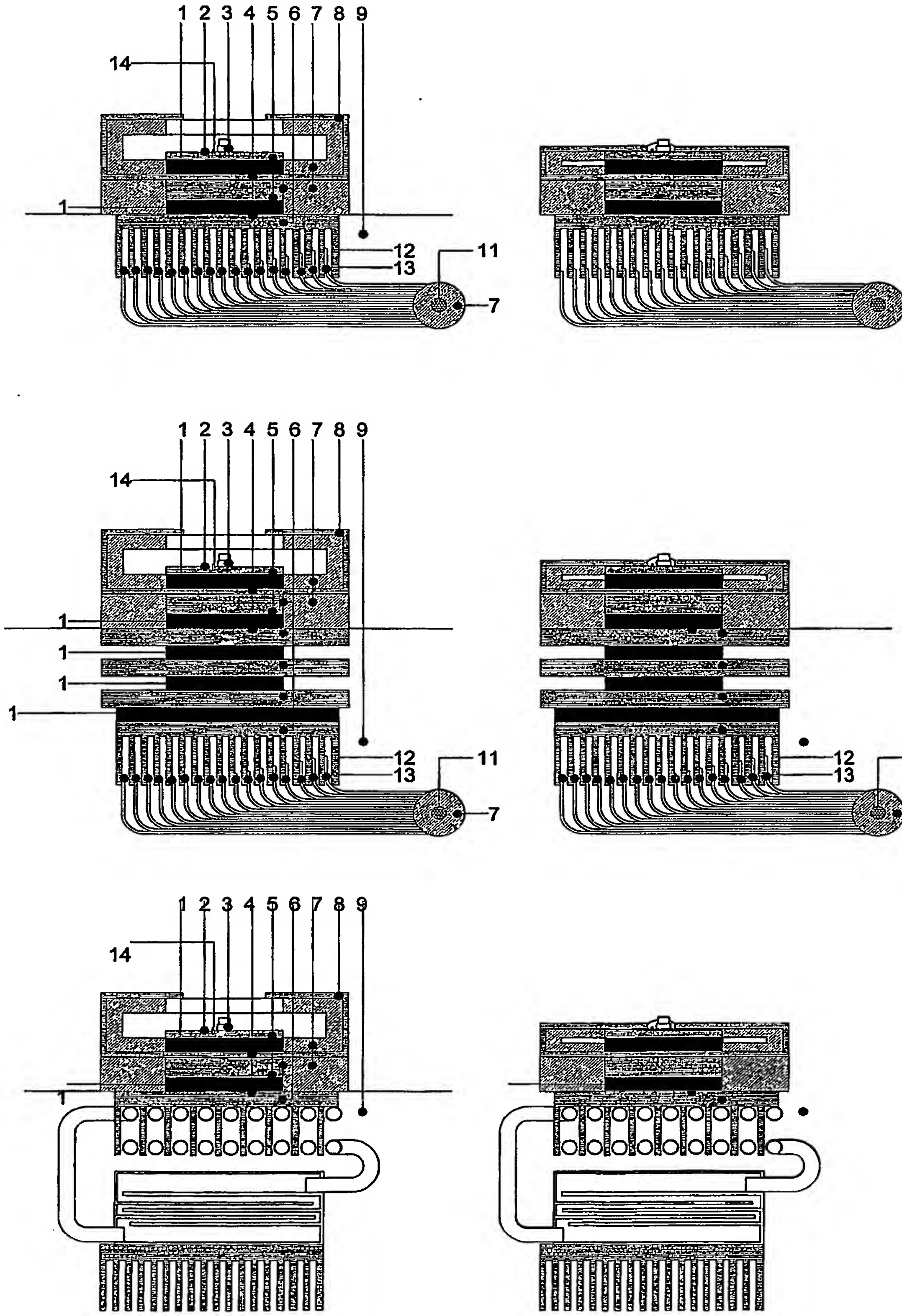

Fig. 1

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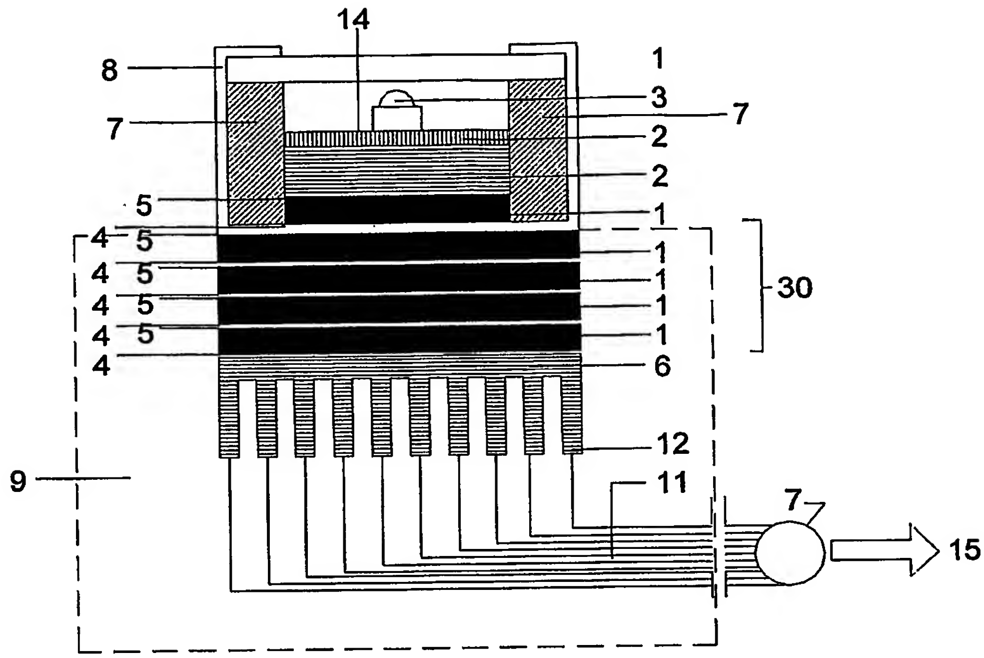

Fig. 2

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PATENT COOPERATION TREATY

31

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(PCT Administrative Instructions, Section 411)

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103

CORRECTED VERSION

1. By means of this Form, which replaces any previously issued notification concerning submission or transmittal of priority documents, the applicant is hereby notified of the date of receipt by the International Bureau of the priority document(s) relating to all earlier application(s) whose priority is claimed. Unless otherwise indicated by the letters "NR", in the right-hand column or by an asterisk appearing next to a date of receipt, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).

2. (If applicable) The **letters "NR"** appearing in the right-hand column denote a **priority document which, on the date of mailing of this Form, had not yet been received by the International Bureau** under Rule 17.1(a) or (b). Where, under Rule 17.1(a), the priority document must be submitted by the applicant to the receiving Office or the International Bureau, but the applicant fails to submit the priority document within the applicable time limit under that Rule, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

3. (If applicable) An **asterisk(*)** appearing next to a date of receipt, in the right-hand column, denotes a **priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b)** (the priority document was received after the time limit prescribed in Rule 17.1(a) or the request to prepare and transmit the priority document was submitted to the receiving Office after the applicable time limit under Rule 17.1(b)). Even though the priority document was not furnished in compliance with Rule 17.1(a) or (b), the International Bureau will nevertheless transmit a copy of the document to the designated Offices, for their consideration. In case such a copy is not accepted by the designated Office as priority document, Rule 17.1(c) provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

Priority date	Priority application No.	Country or regional Office or PCT receiving Office	Date of receipt of priority document
28 Octo 2002 (28.10.2002)	6598	IS	03 Nove 2003 (03.11.2003)

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